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China Report

SCIENCE AND TECHNOLOGY

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CHINA REPORT

SCIENCE AND TECHNOLOGY

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ABSTRACTS

NUCLEAR PHYSICS

NATIONAL DEVELOPMENTS

BRIEFS

FRG INDUSTRIAL AGREEMENT EXTENSION--The five-year agreement concluded in 1979 between the People's Republic and the West German Institute for Standards, after having proved itself advantageous to the economies of both countries, is to be extended. The director general of the State Standardization Bureau and vice president of the Chinese Society for Standardization, Cheng Chuanhui, remarked recently in Berlin that the German industrial standards are regarded in China as the yardstick for high technical quality. Four thousand German standard documents have been translated over the past 5 years and have been made available to the economy as industry guidelines. He cited as an example German machine tool standards now enforced in the PRC as a condition for the delivery of such machinery. Cheng remarked: "One billion Chinese are now studying German industrial standards as the yardstick for technology. [Text] [Frankfurt/Main FRANKFURTER ALLGEMEINE in German 29 Sep 84 p 13]

CSO: 3620/14

OPTICAL PROCESSOR FOR SYNTHETIC APERTURE RADAR

Beijing DIANZI KEXUE XUEBAO [JOURNAL OF ELECTRONICS] in Chinese No 5, 1983 pp 265-270

[Article by Song Jiajun [1345 1367 1486], Yuan Huikun [5913 1979 0981], Wang Wuping [3769 2976 5493] and Mao Yinfang [3029 1714 5364] of the Institute of Electronics, Chinese Academy of Sciences: "An Optical Processor for Synthetic Aperture Radar"]

[Text] Abstract

A three-lens optical processor for the on-site processing of the data of a synthetic aperture radar is described in this work. It is compact, flexible, easily adjustable, widely adaptable and easy to assemble and disassemble.

I. Introduction

An optical information-processing technique has been successfully employed in synthetic aperture radar data processing. It can handle two dimensions simultaneously and has the advantages of high speed, large capacity, high accuracy and simple instrumentation.

The synthetic aperture radar data are mathematically identical to those of a Fresnel diffraction hologram. However, they are quite different from a conventional hologram. The first difference is that the synthetic aperture radar data are a reduced hologram. Furthermore, the reduction power is different in azimuthal orientation and in range. The second difference is that the radar data film is a true hologram in azimuthal orientation but is a simulated hologram created by linear modulation in range. It can also be considered as a parallel multichannel record of range. Therefore, the symthetic aperture radar data are an asymmetrical two-dimensional hologram. This asymmetry makes the data more difficult to reappear as a conventional hologram. A complicated, two-dimensional, asymmetric optical system is required to obtain the picture.

In the data processing of a synthetic aperture radar, a five-lens oblique optical processor is usually employed in other countries. This processor not only is complicated in structure but also requires a vibration-resistant

platform. It is not suited for on-site processing. In order to process in a timely manner the synthetic aperture data on-site, we developed a three-lens optical processor.

II. Principle of Optical Processor

The contrast on a radar image reflects the intensity distribution of scattered microwave signals by the target. This intensity distribution is proportional to the scattering of microwaves by the target, i.e., the radar image is a function $\sigma_{(X,R)}$ of the scattering distribution of the target.

Assuming that the signal transmitted by the radar is a linearly modulated pulse with a rectangular envelop, the antenna is emitting homogeneously, and the target range is far greater than the length of the synthetic aperture; after making some approximations and omitting some irrelevant factors, the signal received by the radar can be expressed as:

$$S(t) = \int_{\frac{c}{2}\left(t-\frac{\tau}{2}\right)}^{\frac{c}{2}\left(t+\frac{\tau}{2}\right)} \int_{X'-\frac{L_s}{2}}^{X'+\frac{L_s}{2}} \sigma(X, R) \exp[j2\pi f_0 t] \exp\left\{-j\left[\frac{2\pi}{\lambda_0 R}\left(X' - X^2\right) - \frac{4\pi\alpha_r}{c^2}(R' - R)^2\right]\right\} dX dR^{[1]*}, \quad (1)$$

where τ is the width of the transmitted pulse, f_0 is the central frequency of the transmitted signal, λ_0 is the central wavelength of the transmitted signal, α_r is the linear-modulating frequency of the transmitted signal, X is the azimuthal coordinate of the target, R is the range coordinate of the target, X' is the azimuthal coordinate of the radar, R' is the range coordinate of the center of the electromagnetic pulse, L_s is the length of the synthetic aperture and c is the speed of light.

From equation (1), one can see that the radar signal is the convolution of $\sigma_{(X,R)}$ and a second-order phase function. Similarly, equation (1) can also be considered as the Fresnel integral or phase-weighted Fourier transformation of $\sigma_{(X,R)}$. Mathematically, image processing is to solve $\sigma_{(X,R)}$ with S(t) known. This operation can be viewed as solving a problem in either convolution, cross-correlation, matching filter or weighted Fourier transformation. These operations are totally equivalent. The optical processor is a coherent simulated optical computer to complete such operations. Therefore, it is also known as an optical correlator.

When using a collimated coherent light to photograph the synthetic radar data on film, the film will diffract the coherent light. The +1 (or -1) order diffraction pattern will form two focal planes: azimuthal and range focal planes. The respective focal lengths are:

$$F_a = \pm\frac{\lambda_0 R}{2P^2\lambda_L}, \quad (2)$$

$$F_r = \pm\frac{c^2}{4\alpha_r q^2\lambda_L}, \quad (3)$$

where λ_L is the wavelength of the coherent light used for processing, P is the scale of the azimuthal orientation and q is the scale of distance.

Because the azimuthal focal plane is related to R, it is oblique. The optical processor must turn this oblique azimuthal focal plane straight so that an image can be formed on the same plane as the range focal plane. The scale P in the azimuthal orientation is also changed to the same scale as the range scale q. Finally, a radar image similar to the shape of the ground target is obtained on the imaging plane.

III. Principle of Three-Lens Optical Processing System

The three-lens optical processing system is composed of two identical spherical lenses and one cylindrical lens, as shown in Figure 1. Spherical lenses L_1 and L_2 form a ranging telescope. Lens L_3 is a cylindrical lens, capable of focusing azimuthally.

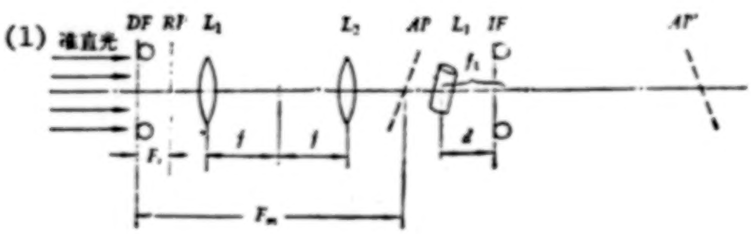


Figure 1. Geometry of Three-Lens Optical System

Key:
1. Collimated light

We considered image formation by the +1 order diffraction of the radar data film, i.e., imaging by real images on the range and azimuthal focal planes.

DF in Figure 1 is the radar data film, RP is the range focal plane, AP is the azimuth focal plane and IF is the imaging plane where the image of RP coincides with IF. AP' is the image of AP, and the cylindrical lens L_3 recreates the image AP' on the IF plane. Therefore, as far as L_3 is concerned, the object distance is $(d + F_m - F_r)$ and the image distance is d. These distances are calculated using L_3 as the origin. According to the lens makers' equation:

$$\frac{1}{d} - \frac{1}{d + F_m - F_r} = \frac{1}{f_3}. \tag{4}$$

From equation (4) one can obtain:

$$d^2 + d(F_m - F_r) - f_3(F_m - F_r) = 0, \tag{5}$$

$$d = \frac{1}{2}\sqrt{(F_m - F_r)^2 + 4(F_m - F_r)f_3} - \frac{F_m - F_r}{2}. \tag{6}$$

The general situation on the azimuthal focal plane is:

$$d = \frac{1}{2}\sqrt{(F_a - F_r)^2 + 4(F_a - F_r)f_3} - \frac{F_a - F_r}{2}. \tag{7}$$

From the maximum d_{max} corresponding to F_a and minimum d_{min} corresponding to F_a, the required angle of inclination for the cylindrical lens L_3 can be calculated:

$$\theta = \mathrm{tg}^{-1}\left(\frac{d_{max} - d_{min}}{\Delta r}\right), \tag{8}$$

where Δr is the width of image in the range direction.

Similarly, the formula for imaging by -1 order diffraction is:

$$d^* = \frac{F_a - F_r}{2} - \frac{1}{2}\sqrt{(F_a - F_r)^2 - 4(F_a - F_r)f_3}. \tag{9}$$

The transversal magnification of the center of the image is

$$M = \frac{d}{d + F_a - F_r}, \tag{10}$$

$$M^* = \frac{d^*}{F_a - F_r - d^*}. \tag{11}$$

Generally, $F_a - F_r >> f_3$. When the azimuthal focal length is very long, equations (7), (9), (10) and (11) can be simplified as:

$$d \approx f_3 - \frac{f_3^2}{F_a - F_r}, \tag{12}$$

$$d^* \approx f_3 + \frac{f_3^2}{F_a - F_r}, \tag{13}$$

$$M \approx \frac{f_3}{F_a - F_r + f_3}, \tag{14}$$

$$M^* \approx \frac{f_3}{F_a - F_r - f_3}. \tag{15}$$

In actual imaging, L_3 must be adjusted in order to focus. Therefore, it is not necessary to calculate accurately. It is adequate to estimate using the four approximated equations listed above.

The distance between the radar data film and L_1 is not required to be precisely f (with the exception of performing accurate frequency spectral analysis). In order to facilitate the imaging process, the data film is usually placed as close to L_1 as possible, which increases the distance between the film and L_2. Consequently, L_3 is given a larger range to satisfy the changes of radar image formation, there are specific requirements for the focal length cylindrical lens L_3 and the aperture. The

length of the cylindrical lens should be larger than the width of the image in the range direction. Its width should be greater than or close to L_s/P. However, it is still usable even if it is slightly narrower. The choice of f_3 should be considered in three areas: (1) $f_3 < f$ due to $d < f \pm F_r$. (2) $M = \frac{1}{K}$ in order to correct the vertical to horizontal ratio from the point of magnification. Here, $K = q/P$ (vertical to horizontal ratio of the radar data film). From equations (14) and (15) we get:

$$f_3 = \frac{F_a - F_r}{K - 1}, \tag{16}$$

$$f_3' = \frac{F_a - F_r}{K + 1}. \tag{17}$$

(3) In order to minimize nonlinear error, f_3 cannot be too large. Instead, it is better to be smaller. Because K is usually greater than 1, f_3 can be smaller than its calculated value. Because the relation between d and F_a is nonlinear based on equation (7) and the relation between the range coordinate of the radar data film r and F_a is linear, therefore the relation between d and r is also nonlinear. Thus, the relation between d and r becomes lower after the inclined cylindrical lens. However, an oblique cylindrical lens cannot possibly form an accurate image for all F_a, which creates a nonlinear error in azimuthal imaging.

From equation (12) and (13), d-F_a is hyperbolic. The larger the relative range of the variation for F_a is, or the larger the value of $f_3/F_a - F_r$ is, the larger the nonlinear error becomes. Therefore, it is favorable to have a smaller f_3 from the viewpoint of minimizing nonlinear error.

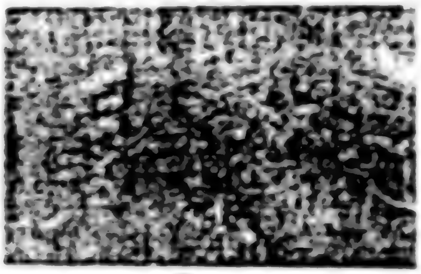
IV. A Practical Three-Lens Optical Processor

The developed optical processing system is the three-lens optical processing system described earlier. Only a few moderately precise lenses were used to obtain relatively good images. Furthermore, it has a wide range of adaptability. It is easy to assemble and disassemble. In addition, there are no special requirements. It does not require special shock-proof and constant-temperature devices. It costs less and is suitable to flight and field tests of aperture radars.

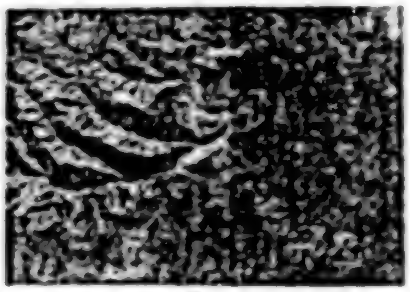
This type of optical processor is comprised of: (1) a He-Ne laser: wavelength 6328 Å and power 15 mW; (2) a beam expanding-collimating system: to expand the laser beam to a 120-mm diameter parallel beam and to limit the aperture to illuminate the data film by an iris; (3) a ranging telescope: formed by a pair of spherical lenses with a 540-mm focal length and a 120-mm aperture; (4) a space filter: a rectangular aperture iris to be placed on the frequency spectrum plane; (5) an azimuthal focusing lens: a cylindrical lens 322 mm in focal length and 60 x 60 in aperture; (6) a radar data film motor: continuously adjustable from 5-300 mm/s with error in speed less than ±1 percent; (7) an image film motor: continuously adjustable from 0.6-6 mm/s with an error of less than ±1 percent; (8) an

imaging slit: adjustable between 0.05-2 mm; (9) a servo circuit: to control the speeds of the data film motor and the image film motor with less than ±1 percent synchronization error; and (10) an optical bench: formed by two sections of 200-mm wide, 4.5-m long channel steel.

From the radar pictures (Figure 2) obtained by the optical processor developed, one can see that the resolution in 80 percent of the area is greater than 15 line pairs/mm except in edges. On a 1:1,500,000 scale picture, it is equivalent to a space resolution of ≤10 m.



a



b

Figure 2. Synthetic Aperture Radar Images
(a) Suburb of Xian; (b) On the south of Fengjiashan reservoir.

V. Application of the Three-Lens Optical Processor

The optical process developed has already been successfully used in flight tests of synthetic aperture radars. In the flight test of the Chinese feasibility prototype synthetic aperture radar in 1979, the first synthetic aperture radar picture was produced by the optical processor. Large targets such as mountains, rivers, bridges and airports could be seen in the pictures. It was used to process on-site real-time radar data film during the flight test of a performance prototype synthetic aperture radar in 1980 to produce all the radar pictures. The pictures were clear and the azimuthal resolution was around 15 m. It was possible to identify mountains, rivers, towns, plants, railroads, highways, and field paths and different types of crops. It has certain practical values.

The optical processor can be used to study the working conditions and existing problems of a radar by performing a real-time spectral analysis of the data film. It has an important effect on the smooth execution of the flight test.

From its use, the optical processor is an economical and practical unit which is reasonably designed, convenient to use and reliable. The quality of the processed image is equivalent to that processed by a right conical lens processor.[2] However, its structure is simpler than that of a conical lens processor. It is also more adaptable, especially in avoiding difficulties with fabricating conical lenses. In terms of simplicity, flexibility and generalization, it is comparable to an oblique processor.

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12553
CSO: 4008/378

NEW AIR SUPPLY/PRIME MOVER FACILITY FOR ENGINE TESTS DETAILED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 7, Jul 84 pp 30-32

[Text] In an effort to enhance the basic capability of engine research, the Beijing Institute of Aeronautics and Astronautics (BIAA) imported an air supply/prime mover facility from the U.S. Ingersoll-Rand Company. The construction of this facility was completed in 1982; acceptance tests conducted during the first half of 1983 showed that all technical specifications basically satisfy the design requirements.

The development of new engines and the verification of technical specifications of engine parts require conducting experimental research under various operating conditions in order to determine their performance and mechanical reliability. Air supply and prime mover facilities are pre-requisites for performing tests on engines and engine parts. Air Supply facility provides the required air flow for the test equipment used in aerodynamic, combustion, blade screen, heat transfer and turbine tests; prime mover facility provides the drive power for testing compressors and transmission systems. The capability of the air supply and prime mover facility will determine the range of parameters and the scope of the tests.

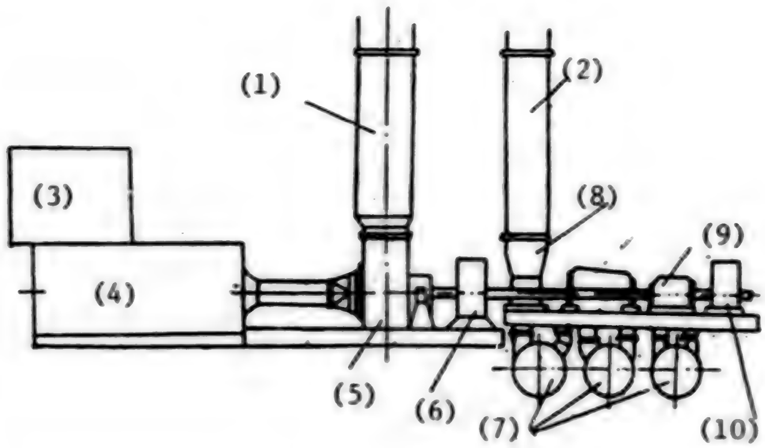
The facility imported by BIAA is primarily used by universities and colleges for research and instruction; therefore, the main requirements of this facility are advanced technical design and versatility. In the following we shall introduce the main features of the components and the overall system of this imported facility.

Components of the Facility

The imported air supply/prime mover facility has the following components: gas generator, power turbine, speed enhancement gear box, automatic monitor and regulator system, and oil circulating system. Its overall layout is shown in Figure 1.

The gas generator is the LM1500 gas turbine built by the General Electric Company. It is a single cycle, single-axle engine modified from the J79 jet engine. Its compressor has a compression ratio of 12.5, the intake guide blade and the stator blades of the first 6 stages are adjustable; the combustion chamber is of straight-flow, annular design with 10 flame tubes. In the 3-stage

Figure 1. Overall Layout of the Air Supply/Prime Mover Facility for Engine Tests



Key:

1. exhaust duct with noise suppressor
2. intake duct with noise suppressor
3. intake filter section
4. noise suppression section and intake air stabilizing chamber
5. power turbine
6. speed enhancement gear box
7. intermediate cooling units
8. 4EX air supply compressor
9. 433 air supply compressor
10. gear box for compressor tests

turbine, the guide blades of the first and second stages are air-cooled. Under sea-level standard atmospheric conditions with no intake or exhaust losses, its rated performance parameters are as follows:

isentropic gas power	17,500 hp
rated speed	7,460 rpm
fuel flow rate	3,370 kg/hr
gas flow rate	74 kg/sec
gas total temperature	513°C
gas total pressure	2.47 kg/cm^2 abs.

With continuous operation under load and 100 engine starts, the operating life of the LM1500 between major overhauls is 20,000 hours.

The power turbine is designed by the Ingersoll-Rand Company to match the LM1500; it is a single-stage turbine for ground use. Under sea-level standard atmospheric conditions, its rated performance parameters are:

output brake horsepower	14,450 hp
rated speed	5,000 rpm
heat consumption	5,222 kcal/hp.hr

The air supply compressor unit consists of three compressors connected in series, its design flow rate is 20 kg/sec. The first compressor is a dual-intake single-stage centrifugal compressor with a design compression ratio of 1.95; the second compressor is a 3-stage centrifugal compressor, the compressed air after the first and second compressors has a design pressure of 8 kg/cm^2abs; the third compressor is a medium-pressure, 4-stage centrifugal compressor, the exit design pressure is 24 kg/cm^2abs. In order to reduce power consumption of the compressors, three cooling units are installed between the stages.

There are two speed enhancement gear boxes. The first gear box raises the speed of the power turbine of 5,000 rpm to 10,400 rpm, as required by the air supply compressor. The second gear box is a special gear box for testing the compressors; by changing the gears, one can change the direction of rotation of the output shaft while maintaining the shaft position; its maximum speed is 14,000 rpm.

Both the gas generator and the air supply compressor unit are equipped with air filters. Each filter has two stages: an inertial filter and a high efficiency paper filter. The noise suppressors at the intake and exhaust are multi-hole mufflers.

Automatic Monitor and Regulator System

The imported unit has an advanced, all integrated-circuit regulator and control system with modular structure. The system contains three sections: program control system, monitor and protection system, and process regulation system. The control panel is shown in Figure 2 [not reproduced].

The program control system is designed to start and stop the unit according to a predetermined procedure as shown in the block diagram of Figure 3. It includes: the programmable sequential control (PSC), the process interface unit (PIU), the process interface unit control (PIUC), and the programmed interface control (PIC). PSC is the nucleus of the system; it is equipped with an RCA 1802 microprocessor which contains user-specified programs. During operation, it receives a signal from the PIU to determine if the condition of sequential execution satisfies the specified requirement, then it sends a command to the appropriate equipment through the PIU control unit. PSC performs the following basic functions: program execution, receiving output signal from the PIU and issuing command to the PIU, communication with PIC module, and self-diagnosis and fault detection.

The function of the monitor and protection system is to send a warning signal or take corrective measure as soon as it detects any trouble that might affect the operation of the unit; in the case of a serious malfunction, an emergency command is issued to stop the operation of the unit. A block diagram of the system is shown in Figure 4. The entire system monitors 44 different parameters on 161 channels; the warning and stop operation threshold values can be changed using an adjusting screw on the corresponding module.

The surge protection system of the air supply compressor uses a special anti-surge module to perform the monitoring function. As the surge line is approached, the flow rate and compression ratio of the compressor are sensed by the

system; it issues a command through the comparative circuit to open the surge valve and keep the unit in normal operating conditions. The anti-surge threshold can be adjusted in advance.

The process regulation system is designed to automatically maintain the specified speed of rotation (when used as a power source) or air supply pressure (when used as air supply). The speed regulation is accomplished using the fuel regulation module. The input operating speed signal is compared with the specified value; any deviation between the two is used to control the fuel rate which in turn changes the speed of rotation to the required value. The speed regulation system is a ratio, integration, and differentiation 3-function regulation system.

There are two regulation systems for controlling the air supply pressure. One uses the fuel regulation module to change the speed of the air supply compressor. Specifically, the air supply pressure signal is compared against the specified value, and the output deviation is used to control the fuel rate. However, this technique cannot meet the requirements of rapid changes during combustion or aerodynamic tests due to its large inertia and the relatively long time required for the regulation process (approximately 30 seconds as shown by unit tests). Consequently, a second regulation system is added where a special fast-response regulation valve with a total travel time of less than 5 seconds is installed in the process control circuit. When a certain deviation in air supply pressure exists, the regulation valve system is activated to maintain the specified value, then the speed regulation system is activated to compensate for the action of the regulation valve; at this point, the valve returns to its original position.

Special Features of the Facility

Versatility. In order to accommodate the large variations in scope and variety of research and instruction programs of colleges and universities, this facility must be highly versatile, i.e., it may be used either as an air supply or as a source of prime mover.

Because of the different sizes in test facilities and different parameter requirements, the air supply must be able to provide air at different pressure levels and different flow rates. On the basis of compressor layout, the air supply pressure can be divided into two different ranges: one is medium pressure air supply, where the pressure range is between 8 and 24 atmospheres; the other is low pressure air supply, where the pressure range is between 2 and 8 atmospheres. In addition, the speed of the compressor can also be varied within a specified range, with corresponding variations in the flow rate. By coordinating the pressure regulation valve and the air distribution valve, the air supply system can provide test flow parameters which vary over a wide range of values.

The prime mover system can drive the compressor and also be used as a power source which provides the required output power within a specified range of rotational speed. Its speed and output power can be varied by adjusting the gas generator. The range of operating speed is 60-105 percent of the design speed; the direction of rotation can also be varied.

Requirement on Technical Parameters. In order to ensure the high standards of test results, the basic parameters of the air supply/prime mover facility are required to high precision and high degree of stability. The precision requirement of the air supply pressure is ± 0.3 percent; and the stability requirement of the prime mover output speed is 0.05 percent. Tests show that this facility meets both these requirements; under high speed operation, the speed stability actually exceeds the specified requirement.

Serial Shaft Design. Generally, when a prime mover system is used to drive both the air supply and the compressor test platform, it is of the parallel shaft design. This requires the design of a special purpose, high-speed gear box which is highly complicated, large in size, and very costly. For example, the British Rolls-Royce Company had suggested such a gear box whose dimensions were 6,600 mm in width, 3,050 mm in length, and 2,030 in height. This type of gear box would cost 5 times more than the serial gear box used in this imported facility.

In order to minimize investment, we chose a design where the drive shaft of the air supply compressor is connected in series with that of the test compressor. This greatly simplifies the design of the gear box, but it also creates two technical problems: one is the problem of critical speed vibration of the 12,116 mm-long connecting shaft; the other is the problem of reducing the power consumption of the air supply compressor to a level comparable to that of the parallel-shaft design when the facility is used to drive the test compressor. Failure to solve these two problems will adversely affect the performance of this facility. For this reason, the following design approaches are implemented:

1. In order to increase the critical speed, we used gear-sleeve shaft joints to divide the critical speed of the long shaft into the critical speeds of several transmission sections, so that only one critical speed exists in the operating speed range. In addition, to reduce the amplitude of vibration, the transmission system is equipped with dip-tile (?) oil gap flat bearings; as a result, the radial vibration of the bearing is within specification when operating at ± 5 percent of the critical speed.

2. We provided a throttle valve for operating the air supply compressor. When the system is used as a prime mover, the intake throttle valve is activated to reduce the flow rate while maintaining sufficient surge margin to ensure normal operation. This design reduces the power consumption of the air supply compressor. Actual tests of the facility show that at design speed, the power consumption of the air supply compressor with throttled operation plus the power consumption of the two transmission gear boxes were less than 2,000 hp, which meets design requirement. In the design suggested by Rolls-Royce, the parallel gear boxes contain 7 pairs of transmission gears; based on a transmission efficiency of 0.98, the total power consumption is approximately 1,800 hp. Therefore, the power consumption of the serial-shaft design is comparable to that of the parallel-shaft design.

High Degree of Automation. Because of the complexity of the system and the stringent requirement on the technical parameters, an electronic, integrated-circuit type regulation and control system is used to perform the functions of

automatic starting and stopping, automatic monitoring and protection of various parameters, and automatic maintenance of specified output process parameters. The high degree of automation simplifies the operating procedure and improves the system stability and reliability.

Compliance With Environment Protection Requirements. In selecting the designs of imported facilities, one of the basic considerations was compliance with environment protection requirements. The main problems with gas generators are noise and pollution due to exhaust gas. To reduce noise, both intake and exhaust ducts are equipped with noise suppressors to meet the noise level requirement for school and residential areas, i.e., less than 70 dB at a distance of 30 m from the intake or exhaust point. Test results show that the actual noise level including background noise was 71-72 dB.

The pollution problem is primarily caused by the exhaust gas from the gas generator. The LM1500 gas generator uses a modified smoke-free combustion chamber which reduces the HC, CO and NO_x contents in the exhaust gas so that pollution standards specified by the U.S. Environment Protection Agency are met.

Currently, this imported facility can directly supply compressed air to the existing test facilities of the engine test laboratory, thereby enhancing their testing capability. BIAA is also in the process of designing an integrated test facility. The imported facility will further raise the standard of engine research and instruction at BIAA. In addition, the advanced technologies used in this facility will provide guidelines for the development of China's ground-based jet engine technology and electronic regulation technology for gas turbines. Undoubtedly it will play a major role in promoting the development of industrial gas turbines in this country.

Figure 3. Block Diagram of the Program Control System

Key:

1. display screen
2. magnetic tape recorder
3. printer
4. to other modules of the control system

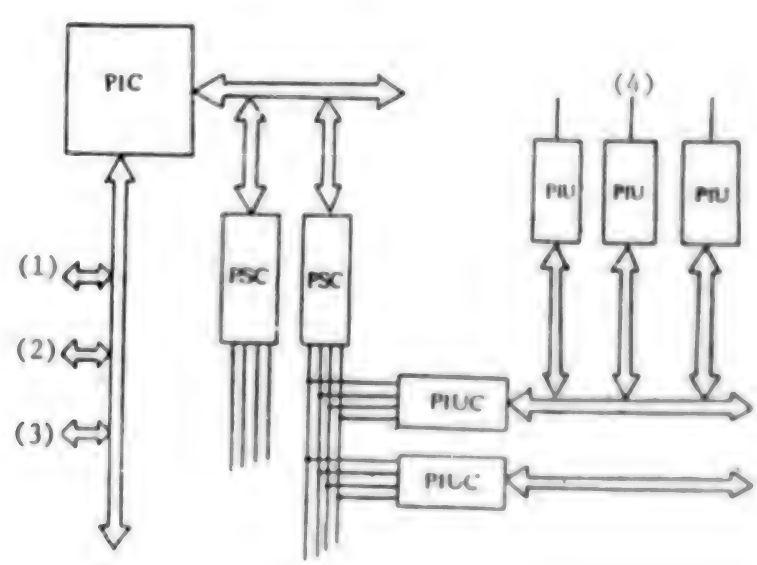
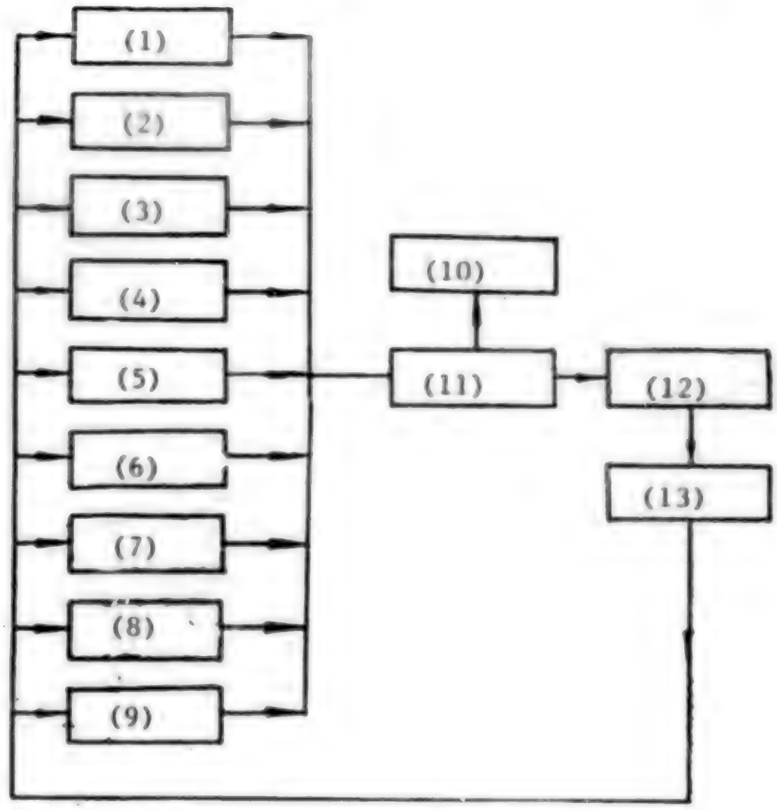


Figure 4. Block Diagram of the Monitor and Protection System



Key:

1. power supply system
2. vibration module
3. displacement module
4. resistance thermometer module
5. rpm module
6. fuel control module
7. power turbine inlet temperature module
8. pressure, pressure differential, and hydraulic pressure signals
9. program control system
10. buzz and light display
11. defective module
12. unit
13. various sensors

3012
CSO: 4008/383

BIOMECHANICS FINDS PRACTICAL APPLICATIONS IN AEROSPACE RESEARCH

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 8, Aug 84 pp 2-3

[Article by Xu Yanghe [1776 2799 4421]: "Biomechanics in Aerospace"]

[Text] Biomechanics is a new branch of science developed in the 1960's. It is the study of mechanical properties of biological parts using the basic principles of mechanics and engineering methods; it involves the use of formulas and quantitative calculations to analyze and understand physiological phenomena. In other words, biomechanics is an interdisciplinary science involving both engineering and biology or medicine.

What, then, is the relationship between biomechanics and aerospace?

It is known that high-performance military aircraft with a Mach number greater than 3 are already being used in practice; in manned space flight, astronauts have established a record of surviving 211 days in space; in recent years, U.S. space shuttles have flown many successful test flights and are ready for commercial use. All these developments require the solution of not only a series of engineering and technological problems but also many important problems in biomechanics of the human body. One can say that biomechanics promotes the development of aerospace, and the development of aerospace in turn presents new challenges for biomechanics.

Application of Biomechanics in Aviation Rescue

When troubles develop in an airplane and force it to abandon the flight, immediate measure must be taken to allow the flight personnel to leave the aircraft and return safely to the ground. If the aircraft flight speed is 600 km/hr, the air pressure acting on a human body can reach 600 kg; under such large aerodynamic force, it is very difficult for the pilot to exit from the aircraft on his own accord. As a consequence, the approach of ejection rescue was invented. The so-called ejection rescue consists of the use of a ballistic or rocket ejector to launch the pilot's seat and the pilot from the aircraft, separating the pilot from his seat according to a certain fixed procedure, then opening a parachute for a safe landing, as shown in Figure 1.

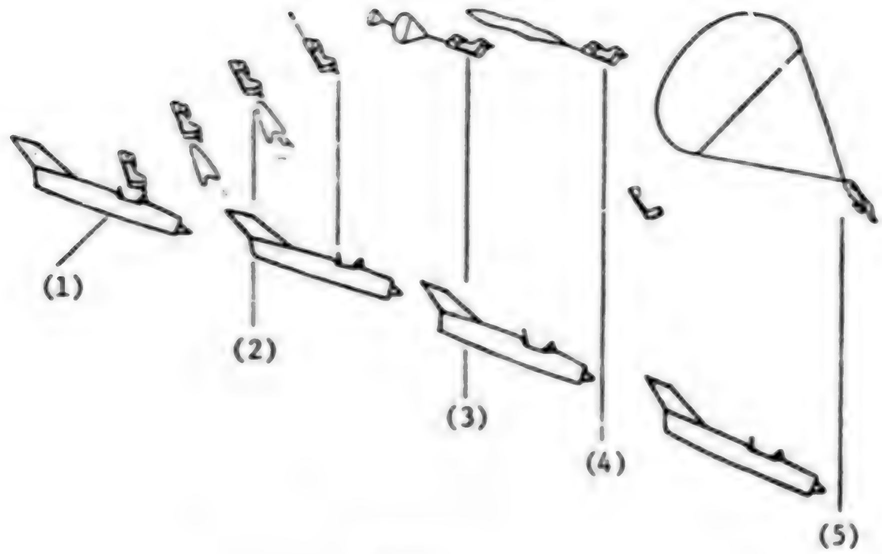


Figure 1.

Key:

1. At 0 second, the ejector rocket is ignited
2. At 0.45 second, the rocket engine completes its burn
3. At 1.00 second, the stabilizing chute is activated
4. At 1.50 second, the parachute is activated
5. At 2.65 second, the parachute is fully opened

A unique feature of the ejection procedure is its short action time, which generally is of the order of 0.2 seconds. To achieve the maximum velocity within such a short time requires that the acceleration of ejection must be very large because velocity is the product of acceleration and time. Therefore, the impulse force exerted on the human body through the pilot's seat during the instant of ejection is very large. This impulse force is primarily supported by the vertebral column of the body. Since the line of thrust of the ejector seat does not coincide with the axis of the vertebral column, the human body is subject to not only a vertical inertial force acting through the center of gravity, but also a horizontal component which tends to push the body forward, as shown in Figure 2. Because of the natural curvature of the vertebral column, the maximum force generally occurs in a region between the 10th vertebra thoracalis and the first vertebra lumbalis; in particular, statistical data show that the 12th vertebra thoracalis is subject to the most severe load. Excessive pressure on the vertebral column will cause injuries to the column, which may involve a fracture of the forward edge of the vertebra or compressive injury to the vertebra.

One of the important topics of biomechanics in aerospace application is to study the exertion of force on the vertebral column during ejection and the physiological mechanism of injuries suffered by the vertebral column and its prevention. The study of mechanical properties of the vertebrate can be classified as a part of bio-solid mechanics.

Biomechanical Problems Caused by Weightlessness

Weightlessness is a unique phenomenon of space flight. Today, as astronauts can remain in orbit for 211 days, it appears that living and working under weightless conditions no longer present any problem. However, this is not true in reality. An important problem is that under weightless conditions, astronauts will suffer the loss of certain minerals in their bone structure (mainly calcium and phosphorous), causing osteomalacia and bone atrophy, leading to possible bone fracture and deformation.

Scientists in the United States and the Soviet Union have conducted large numbers of non-human biological experiments as well as experiments on human bodies. On the Soviet "Cosmos" satellites, changes in the metabolism and mechanical properties of bone structures of mice were observed after living 18 days under weightless conditions. The experiment showed a 45 percent reduction in the rate of bone formation among the mice tested. A study in the United States showed losses of calcium and phosphorous in the wastes produced by astronauts. The rate of calcium loss is approximately 6 g per month, which corresponds to 0.5 percent of the total monthly calcium content in the body.

This is actually a problem in skeleton biomechanics involving the relationship between stress and growth. The human skeleton has the ability to maintain its internal stress condition through the process of growth and absorption in order to accommodate changes in external forces. Growth or absorption (and shrinkage) of bones will take place according to body needs. Under weightless conditions, the entire skeleton is free from gravitational forces; hence the bones, particularly those used to support weight, will lose calcium and shrink.

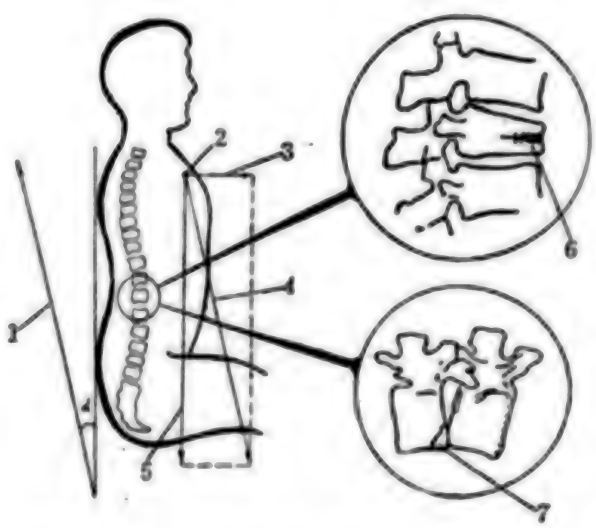


Figure 2. Schematic Diagram Showing the Forces Exerted on a Human Body by the Ejector Seat and the Body Locations Most Likely to Suffer Injuries

Key:

1. Line of thrust
2. Center of gravity
3. Horizontal component
4. Inertial force
5. Vertical component
6. Fracture in the forward edge of the vertebra
7. Compressive injury to the vertebra

Currently, the following methods are used to prevent bone loss under conditions of weightlessness.

1. During flight, astronauts perform exercises which simulate conditions on earth to exert force on the skeleton. For example, on the Soviet "Soyuz-9," astronauts trained with a set of integrated exercise routine; astronauts on the U.S. "Gemini-7" performed daily exercises using exercise equipment.

2. The use of physical methods for prevention and cure, which include the use of special equipment to apply pressure in the longitudinal direction of the body, and the application of negative pressure in the lower part of the body.

3. Increasing the calcium and phosphorous intake in the diet. In particular, increasing the amount of calcium and phosphate in the diet provides a direct means of suppressing bone absorption and stimulating bone formation.

4. The use of medication.

However, none of the above methods is totally satisfactory; the latter two methods actually produce certain side effects. Thus, the problem of loss of bone minerals and reduction of bone density under weightless conditions has not been completely solved. The mechanical effect of gravity on the process of bone regeneration is not fully understood. Consequently, the effect of weightlessness on the mechanical properties of the skeleton remains an important problem in the current development of aerospace industry and in bedside biomedicine.

Why Are Some Aviators Prone to Coronary Heart Disease?

A survey of retired U.S. pilots showed that the main medical reason for stopping flying was due to coronary heart disease. Later, autopsies of the bodies of 200 pilots killed in accidents also showed that 70 percent of them suffered various degrees of arteriosclerosis. Why are some aviators prone to coronary heart disease?

Studies show that aviators not only extract more fat from their diet, they are also constantly in a state of stress and are subject to adverse conditions of oxygen shortage, acceleration, and temperature changes. There are many theories explaining the causes of arteriosclerosis, but basically the internal cause is a high cholesterol level, and the external cause is infiltration of fat into the artery walls due to oxygen shortage and dynamic effects of the blood stream.

Tests have shown that the fatty tissues in the hardened arteries come from the blood stream, and the local oxygen shortage in the artery walls is the main cause for fat deposit and deformation of the artery wall, leading to arteriosclerosis. The location where such phenomena occur is closely related to the motion of the blood stream.

The flow of blood in the blood vessel exhibit the following properties:

1. Both laminar and turbulent flows occur in the blood vessel. In the case of laminar flow, the blood stream is in the form of layers with uniform streamlines; there is only sliding motion between the layers, the direction of motion remains constant, and the flow speed is relatively slow. In the case of turbulent flow, the streamlines are irregular; there is considerable momentum exchange between the molecules, which move in all directions; the flow speed changes from one instant to the next, and is highly unstable.

2. The velocity and pressure of the blood stream essentially obey Bernoulli's law: the higher the velocity, the lower the pressure; the lower the velocity, the higher the pressure. Figure 3 shows a section of the artery which has narrowed due to pressure from neighboring organ; as a result, the velocity of blood stream is increased and the pressure is reduced.

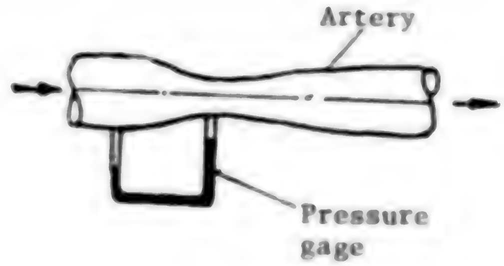


Figure 3.

3. At a fork joint of blood vessels, the velocity of blood streams along the inner walls tend to increase, with a corresponding drop in pressure, as shown in Figure 4.

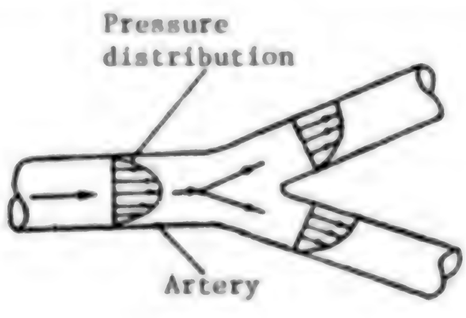


Figure 4.

4. When the blood flows past a curved portion of the blood vessel, centrifugal forces cause the static pressure to increase and velocity to decrease along the wall with the larger radius of curvature; the opposite is true along the wall with the smaller radius of curvature, as shown in Figure 5.

In view of the above physical characteristics of blood flow, it can be shown that arteriosclerosis is likely to occur at a point where the blood vessel changes shape; such a location is also where turbulent flow is likely to take place. In addition, the effect of acceleration increases the blood pressure and further induces the occurrence of turbulent flow.

Figure 5.

The investigation of the effect of blood flow on the cause, the location, and the development of arteriosclerosis is a problem in biofluid mechanics.

The three topics discussed above are only issues which are closely tied to aerospace and biomechanics. In fact, biomechanics is also used in the study of pressurized oxygen supply, the design of pressurized suits, the study of forces acting on passengers during an airplane crash, the determination of human endurance to sudden deceleration, the design of band-limited control systems, the study of head injuries of pilots and endurance limits to injury, as well as the design of protective helmets.

3012
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HEALTH WORK SHOWS IMPROVEMENTS IN RECENT YEARS

OW130810 Beijing XINHUA in English 0751 GMT 13 Sep 84

[Article: "PRC: China's Efforts To Improve General Health in Countryside"]

[Text] Beijing, 13 September (XINHUA)--Most peasants in China find medical services within walking distance, as 87 percent of China's production brigades have their own clinics.

This basic access to medical attention also includes referral to town hospitals, roughly one-third of the cases, with complicated cases being transferred to county institutions.

As village medical service has been improving in recent years, the number of patients needing referral has been decreasing. All big urban hospitals send out teams of experienced doctors to tour the countryside to treat difficult cases and to help train local doctors.

Almost 60 percent of the nation's 620,000 village clinics are run by the collective. Medical personnel are paid by the collective. The peasants who join, pay a small sum a year. When the collective medical fund is not enough, the brigade gives a subsidy out of its welfare fund.

Around 10 percent of the clinics are run jointly by several country doctors or by barefoot doctors. Individual practitioners account for 25.5 percent of the rural medical force. All local medical practice is supervised by the state and all doctors have to pass qualifying tests.

The 1.68 million medical personnel in county and town hospitals are either on the government payroll or government subsidized.

State-run county hospitals, apart from treating the sick, also provide technical guidance for the local doctors, take care of disease prevention, public health and sanitation campaigns and family planning function.

The key to China's public health work is "prevention first." A nationwide disease prevention network is guided by 3,274 centers scattered in all parts of the country. The 130,000 regular personnel are aided by the rural country and barefoot doctors.

Disease prevention covers inoculations, vaccinations, and distribution of preventive medicines. It also means investigation of water sources and sanitation, nutrition and public health education.

Water samples are taken regularly from China's 5 major systems, 177 rivers and 5 major lakes. The government then adopts measures to deal with pollution or add missing substances to drinking water.

Education on nutrition and a balanced diet is becoming more feasible as China's rural areas prosper.

Government attention to massive afforestation is in part due to consideration of the detriment to people's health in the countryside from sand and wind storm.

But the most important factor in improving health is the people's cooperation.

Average life expectancy has risen in the past 35 years from 35 to 67.88 at present. Malnutrition, diarrhoea and infectious and parasitic diseases are no longer the main causes of death. Infant mortality has dropped from 200 per thousand to 34.68 per thousand. A survey of nine cities and surrounding rural areas showed that a 9-year-old child averages 5.4 centimeters taller and 2.4 kilograms heavier than a child the same age in 1949.

James Grant, UNICEF executive director, commented on China's health work at the interregional seminar on primary health care held in 1982 in China. He summed the advances due to political will, a serious commitment at the highest level of government to the social goal of health for all, as well as mass health campaigns and widespread mass participation.

He noted that social and economic equity, an enlightened agricultural and industrial policy and universal education are just as important for the attainment of health as an efficient health network.

CSO: 4010/2

CONTRIBUTIONS TO INDUSTRIAL HYGIENE, OCCUPATIONAL DISEASE CONTROL

Tianjin ZHONGHUA LAODONG WEISHENG ZHIYEBING ZAZHI [CHINESE JOURNAL OF INDUSTRIAL HYGIENE AND OCCUPATIONAL DISEASES] in Chinese No 1, 25 Feb 84 pp 2-7

[Speech by Liu Shijie [0491 0013 2638] to the National Academic Meeting on Industrial Hygiene and Occupational Diseases at Hangzhou, 30 Nov 83: "Improve Quality and Work Hard To Contribute More to Industrial Hygiene and Occupational Disease Control in China"]

[Text] The Third National Academic Meeting on Industrial Hygiene and Occupational Diseases sponsored by the Chinese Medical Society was successfully held from 8-13 November 1983 under the auspices of the State Science Commission and Ministry of Public Health and with the support of the leadership and comrades of the Zhejiang People's Council, Zhejiang People's Government, Zhejiang Science Commission, Zhejiang Science Association, Zhejiang Public Health Department, Zhejiang Chapter of Chinese Medical Society, Zhejiang Health Laboratory Institute of Occupational Disease Control, Zhejiang Medical School, Zhejiang Public Health and Epidemic Prevention Station and Hangzhou Public Health and Epidemic Prevention Station. The delegates and conference staff worked enthusiastically to achieve a smooth ending.

I.

Ouyang Jin [2962 7122 4544], vice president of the Chinese Medical Society; Tang Shuangzhen [3282 7175 2182], deputy director of the Public Health and Epidemic Prevention Section of Ministry of Public Health; and more than 300 official delegates, invited delegates and non-voting delegates (242 official and 52 non-voting delegates) from the National Chinese Labor Union and the concerned industrial departments of the central government, provinces, cities and autonomous regions attended the meeting. In addition, professionals in industrial hygiene and the control of occupational diseases in Zhejiang also attended as non-voting delegates. A leadership group was created in a preparation meeting and was formed by the standing members of the Second National Committee and relevant comrades in leadership positions.

The opening ceremony was presided over by Liu Shijie, acting chairman of the Second National Academic Meeting on Industrial Hygiene and Occupational Diseases. Ouyang Jin, vice president of the Chinese Medical Society, delivered the opening speech. Ma Shougen [7456 1108 2704], deputy secretary general of the Zhejiang People's Government, addressed the meeting. Tang

Shuangzhen, deputy director of the Public Health and Epidemic Prevention Section of the Minitry of Public Health, gave his report on further strengthening research on industrial hygiene and the control of occupation diseases. Wang Jiwu [3769 1323 0582], chairman of the Zhejiang Science Commission and president of Zhejiang Medical School; Dai Di [2071 6611], chief of the Public Health Bureau; consultant Chen Guo [7115 6605]; and Qian Mingqi [6929 7686 1477]; party secretary of the Science Association, also participated in the opening ceremony.

Based on the requirement of the National Science Commission that the number of special scientific committee members not exceed 35 and that qualified new members under 50 be given priority, 22 of the original 56 members were elected in the Second Standing Committee meeting of the Second National Committee on Industrial Hygiene and Occupational Diseases. Thirteen new candidates were nominated by the cities. After careful consideration, 35 members of the Third National Committee on Industrial Hygiene and Occupational Diseases were approved. The first committee meeting was held on 8 November. Through negotiation, 11 standing members were selected. Comrade Liu Shijie was selected chairman and Comrades Jin Cui [6855 4773] and Gang Baoqil [0474 5508 3825] were the vice chairmen. Because Professor Gu Xueji [7357 1331 4614] requested not to stay on as vice chairman, a standing member position was left vacant to be jointly evaluated by the National Committee and the Shanghai chapter. The members discussed the meeting enthusiastically. In principle, it was approved to hold the Fourth National Academic Meeting on Industrial Hygiene and Occupational Diseases in 1987 or 1988. It was suggested that it be held in the Northwest Region.

More people attended this meeting than the past two meetings. It involved a wide range of complete special fields. Experts and professors who have engaged in scientific research and teaching for years, professionals who have been involved in industrial hygiene and the control of occupational diseases and managers in industrial hygiene attending the meeting. There were many young comrades especially who stood on the front line of industrial hygiene and occupational disease control. There will be more accomplishments and more significant economic benefits.

This meeting proceeded smoothly because more time was available for preparation. As early as May this year, more than 1,200 papers were submitted by provinces and cities. Of these, 890 were included in the symposium after careful review and revision by the preparation committee. There were 364 papers on industrial toxic substances, poisoning and clinical occupational diseases, 290 papers on dust and pneumoconiosis, 127 on physical factors and labor physiology, 49 on health monitoring tests and 60 on other areas. It was printed prior to the meeting in order to facilitate exchange among delegates. Just as the group conveners reflected in their briefing, the materials exchanged in this meeting were not only high in quantity and rich in content but also good in quality. The depth and breadth of the research and the new techniques and methods employed were better than those presented at the Second National Academic Meeting on Industrial Hygiene and Occupational Diseases. This demonstrates that we have made great progress in the research on industrial hygiene and the control of occupational diseases. These studies

filled some of the void in the past. Some of the results were of a world-level quality and received praises from comrades attending the meeting. Many studies paid attention to production and reality. They tried to combine theories, experiments and on-site studies. Clinical observations and health surveys were also integrated. Major industrial hygiene problems and occupational hazards facing industries and agricultural production were closely analyzed, investigative studies and epidemiological analysis were launched and some results have already been successfully applied.

Hence, this meeting was a review of major accomplishments in the study of industrial hygiene and occupational diseases in China during the past 4 years. It was a meeting to exchange experience, to learn from one another and to improve ourselves collectively. It was a meeting to establish health standards and guidelines as well as provide a scientific basis for legislation. It was also a meeting to discuss future research directions in industrial hygiene and occupational disease control, to identify the local points and to select the projects to tackle.

This meeting was lively and vigorous due to sufficient preparation and apparent objectives. Special-topic reports were given in general sessions. Papers were presented and discussed according to special fields in group meetings. In addition, some results in disease control and samples of monitoring instruments were exhibited (ly in all with 58 posters). Everyone not only listened to the papers and participated in the discussions but also saw the exhibition of some figures and actual devices. Many delegates indicated that this was beneficial.

Ten special-topic reports were presented in the meeting surrounding the issue of the formulation and legislation of standards. These topics were: 1) the progress and standardization of monitoring and testing methods in industrial hygiene; 2) recommendations on the accelerated drafting of maximum allowable concentrations for toxic substances in workshops; 3) procedures for drafting maximum allowable concentrations of industrial toxins; 4) problems in drafting maximum allowable air dust concentrations in workplaces; 5) opinions on formulating diagnostic indicators for local vibration disease; 6) investigation on diagnostic indicators for local vibration disease; 7) study of the effect of sulfur dioxide on embryo and fetal growth; 8) evaluation of the comprehensive dust control measure at the Zhejiang Dongfeng Yingshi Company and analysis of its socioeconomic benefits; 9) overview of the formulation of pneumonconiosis control legislation in the People's Republic of China; and 10) investigation of five industrial poisonings and analysis of causes. Through these reports, everyone gained a greater understanding regarding the importance and urgency of formulating health standards and diagnostic standards for occupational diseases. The way standards were set in the world was understood. Furthermore, they also got a clear idea about the basic requirements of setting standards such as grasping information, selecting methods and indicators, determining bases and developing programs. After the meeting, discussions were held by the administrative regions.

Group meetings were held in seven special fields: 1) 29 papers were presented in the clinical pneumoconiosis and epidemiological survey group; 2) 21 papers

in the dust hygiene group; 3) 33 papers in the clinical occupational poisoning group; 4) 29 papers in the toxicology group; 5) 23 papers in the physical factor and labor physiology group; 6) 32 papers in the health survey group; and 7) 15 papers in the health monitoring group. The total was 222. After the group meetings, special-topic discussion sessions were held on pneumoconiosis law, the implementation of preventive measures for dust workers (with the emphasis on modifying diagnostic standards for pneumoconiosis), health standards for toxins, health standards for dust, diagnostic standards for occupational diseases, industrial hygiene for women, health monitoring, standards for physical factors and occupational epidemiology. Many suggestions and modifications were presented.

II.

China has changed politically and economically during the 4 years since the Second National Academic Meeting on Industrial Hygiene and Occupational Diseases. Since the 3d Central Committee Meeting of the 11th Party Congress, the Party Central Committee and the State Council set a series of correct policies to switch the focal points of the party and the nation to socialist modernization. Order was brought out of chaos to realize a great historic turnaround. In particular, it was decided at the end of 1980 to adjust the national economy further to lead the Chinese economy on a healthy track. Every business is showing signs of prosperity.

The current situation appears very good. The health front, just as other lines, has done a great deal of work and has obtained significant results. A lot of experience has accumulated in the research on industrial hygiene and occupational disease control in order to protect the health of the workers and to contribute to the four modernizations.

The Ministry of Public Health did a great deal of work on the national organization, management and development of industrial hygiene and occupational disease. For example, after the 1980 national industrial hygiene meeting, the concerned departments strengthened their industrial hygiene work. The experience of advanced dust and toxin control units was expanded. Significant economic and social benefits were received. The report ("Evaluation of Dust Control Measures at Jade Mine in Zhejiang Dongfeng") was a typical example.

In order to understand the basic situation of occupational diseases in China, a nationwide survey of the hazards of five toxins such as lead, benzene, mercury, organic phosphorus and trinitrotoluene was conducted. The hazards were identified for various regions, departments, trades and positions. It was reviewed in this meeting. An epidemiologic survey of eight carcinogens such as arsenic, benzene, chromium, asbestos, benzidine, vinyl chloride, chloromethyl ether and effluents from furnaces.

The Ministry of Public Health established the National Technical Committee on Health Standards in February 1981. It organized national resources to develop and modify industrial standards and occupational disease diagnostic standards and provided a scientific basis for health monitoring and worker health protection. In 1982 the Ministry of Public Health organized a group to draw up a pneumoconiosis law and created a draft of the ("Pneumoconiosis

Control Law"). The content of this work was also introduced in the meeting. In conjunction with the drafting of a pneumoconiosis law, the Society and the Ministry of Public Health jointly held a national academic discussion meeting on pneumoconiosis in Fushun, Liaoning, in December 1982. Problems such as the definition of pneumoconiosis, lists of patients and the management levels at dusty plants were discussed in depth. Furthermore, a unanimous opinion was obtained, which provided a scientific basis for drafting a "Pneumoconiosis Law" in China.

In order to ensure that industrial hygiene and occupational disease control could satisfy the needs of national construction, a national and seven regional industrial hygiene and occupational disease control centers and instruments. Key support will be given in operating expenses and instruments. Furthermore, national industrial hygiene and occupational disease training bases will be set up in the hygiene departments of six universities. Suitable financial support will also be provided. They will actively train and improve the technical staff.

In order to coordinate with the Ministry of Public Health as well as promote research on industrial hygiene and occupational disease control, many comrades in prevention, research and teaching have completed a great deal of work and achieved many high-quality results. The special feature of these research results is that they are closely related to actual needs in production and national development for the four modernizations. Furthermore, a strong scientific basis for drafting or modifying health standards or diagnostic standards was provided.

In the areas of dusts and pneumoconiosis, in-depth epidemiological or experimental studies were carried out in recent years to determine the disease-causing effects of the dusts of over 50 kinds of silicates, metals and organic materials. These accomplishments were revealed in the discussion meeting on the causes of pneumoconiosis held in Fushun, Liaoning. More attenion is now being paid to the correlation between dosage and reaction in the mechanism on the effects of dusts on macrophage, the effect of the immune mechanism and protein factor on silicosis attack and the metabolic and curative effects of medications such as aluminum citrate. In terms of techniques, electron microscopy is more widely used. In addition, x-ray diffraction, electron scattering and x-ray spectral analysis are also used to study dusts in tissues. The number of organizations and cases of autopsies on pneumoconiosis victims is increasing. X-ray and pathological comparison studies are done in greater depth. On the basis of the original standards, we plan to modify the pathological diagnostic standards for pneumoconiosis. In the past 3 years, we have already accepted the idea of a general diagnostic standard for pneumoconiosis after repeated discussions. Further discussion was carried out on the special-topic report presentation on the "Implementation of Medical Preventive Measures for Dust Workers." Many good opinions were put forth. These ideas were relayed to the Subcommittee on Diagnostic Standards for Occupational Diseases as references when it reviews these standards.

Safety evaluations and laboratory toxicity studies of industrial and agricultural chemicals were only performed in a few medical schools and research

organizations at the provincial and city levels are also involved in this area. Tests for the "three causes" (for abnormality, cancer and mutation) are already very widespread. One-third of the toxicology papers received in this meeting belonged to this area. In addition to the national survey of the five industrial toxins mentioned above, on-site epidemiological surveys and clinical solvents and agricultural chemicals were also conducted and certain accomplishments were obtained. Through a great number of on-site epidemiologic surveys, clinical observations and toxicity tests the maximum concentrations of more than 20 toxic species in the air in a working environment as well as diagnostic standards for occupational poisoning by benzene, flourine, maganese, carbon dioxide and TNT were drafted or modified during the past 4 years. The standards for a number of other toxic species and diagnostic standards for occupational poisoning by chlorine gas, chloropropylene, organic flourine and tetraethyl lead will be submitted for review in the near future.

In the area of detection methods and techniques, a research coordination group on air monitoring and detection for working places was established in 1975. A great deal of work has been done over the years. More than 40 organizations have joined this outfit to date. They are dedicated to the standardization of detection methods across the country. It organizes studies of analytical methods in order to match them with newly drafted hygiene standards. It is involved in the quality control of analytical techniques and in importing new technologies and sampling techniques. More than half the papers on the subject of detection received in this meeting belonged to the coordination group. In addition, a lot of work was done on the normal values of toxic species in biological media in recent years.

In the area of physical factors, many outside and laboratory studies of noise, vibration, high-frequency electromagnetic fields, microwaves, infrared and ultraviolet light, mountain sickness, decompression sickness and high and low temperatures were conducted. Through a great number of surveys, the diagnostic standard for local vibrational sickness will be reviewed. An epidemiologic survey is being carried out in over a dozen provinces and cities on the effects of noise. In the area of labor physiology, the labor load, energy metabolism and physical labor were also investigated. Relevant health standards were also presented. In addition, work has begun on human efficiency studies. Results will be obtained in the near future.

The major tasks performed in the past years were also reflected in the papers presented in the meeting. From the quantity and quality of the papers, the depth and breadth of the research and the use of new techniques and methods, significant progress was obtained compared to the work presented in the last meeting. It is seen specifically in the following areas:

(1) The scope of research was relatively wide. The number of toxins studied in the papers received in this meeting was significantly higher than that of the last meeting. Only about 60 toxins were included in the papers in the last meeting. It was increased to more than 160 in this meeting. In the last meeting, 26 inorganic and 8 organic dusts were studied with reference to

pneumoconiosis. In recent years, over 50 kinds of dusts were investigated. Organic dusts especially have attracted more attention.

Research on physical factors has developed rapidly. The number of papers increased significantly compared with that in the last meeting. For instance, there were only a few noise-related papers in the last meeting, while the symposium for this meeting included 47 papers. The noise survey in 9 provinces and cities involved 9 trades, 80 types of jobs, over 1,000 plants and more than 10,000 sound sources and 40,000 workers. The scale was unprecedented. The number of professionals engaged in the study of physical factors also increased significantly. The number of people attending the physical factor group doubled that in the last meeting.

(2) Research subjects were more profound and the quality was improved. In the study of pneumoconiosis, its classification, diagnostic standard, attack mechanism and curative mechanism were investigated in detail. Toxicity studies have already been developed on the molecular level. Metabolic dynamics and isotope tracer studies have been initiated. The study of the combined effect of industrial and domestic toxins was also launched to broaden the scope of research. In some cases, accumulation patterns and mathematical models were used to formulate the maximum allowable concentrations of certain toxins. Despite this, there are still many problems yet to be resolved. However, it is worthwhile noticing that the drafting of hygiene standards has been accelerated.

(3) New techniques and methods were used. In toxicity and dust studies, electron microscopy has already been widely used. Techniques such as determination of free silicon dioxide by x-ray diffraction, infrared spectral analysis of silicosis in the lungs of mice and detection of lung magnetic field have attracted a lot of interest. In the study of the "three causes" of toxins, the delegates gave high marks to new techniques such as chemically induced chromatid exchange of V_{79} cell, the establishment of a tumor cell model in a test tube with chemicals and a sex-linked dominant lethal experiment with fruit flies. In the detection of toxins in the environment, studies of individual sample collection and atomic absorption spectrophotometry have already been launched. Gas chromatographic and fluorescence analysis techniques are already widely used to improve the separation techniques and sensitivity significantly. They provided advanced techniques for studying various hygiene standards. In the clinical poisoning area, the measurement of nerve conduction speed provided a reliable method for the early diagnosis of peripheral nerve poisoning. The determination of β_2 microspherical protein in urine offered a sensitive indicator of chronic cadmium poisoning. Red cell zinc protoprophyrin also provided a sensitive biological indocator for lead hazards.

(4) Emphasis was placed on combining theory with practice in applying research results to actual work. Many studies of industrial toxins, dusts and physical factors included not only animal tests and clinical observations but also data on production environment health surveys and epidemiological observations. Furthermore, control measures and hygienic or diagnostic standards were also recommended. More than half of the papers presented in this meeting

meeting were valuable in drafting health and diagnostic standards. The speeches given in the meeting as mentioned before were also centered around an overall introduction to standardization. According to the "Hygiene Standards Drafting Plan in the Sixth 5-Year Period" officially issued by the Ministry of Public Health in April 1982, 37 diagnostic standards for occupational diseases and 63 health standards for maximum toxin and dust concentrations in the air and for physical factors on a production site must be formulated (or modified). To date, 12 diagnostic standards of occupational diseases and 28 workshop hygiene standards have been completed.

We must continue our hard work to draft and pass these standards ahead of schedule. In addition to the improved quality and quantity of the papers received in the meeting, it is also worthwhile mentioning that the academic atmosphere was more lively. Academic democracy was fully carried forward. Delegates could express different views and constructive suggestions and talked freely about their own opinions. Everyone should be academically equal. This spirit should be encouraged.

III.

Since the 3d Session of the 11th Party Congress, the Party Central Committee has already set a complete series of policies for the new socialist construction era. Our task is to mobilize the vast number of scientific researchers to participate actively in socialist construction under the leadership of the party, the Chinese Medical Society and the Ministry of Public Health. We must unite and depend on the members and local leaders to continue academic activities. We must work hard to prepare for various training courses to raise the level of technical personnel. We must keep on improving the quality of workers in labor hygiene and disease control. We must popularize science and gradually expand our academic exchange with the rest of the world. We must strengthen the society to contribute more to material and spiritual civilization. Our current tasks are centered around the need to adjust and develop the national economy. We must work hard to promote the development of industrial hygiene and the control of occupational diseases. The effectiveness of prevention and control will be improved in order to protect the health of the vast number of workers. Our future academic activities are required to be closely linked to the administrative requirement in public health and development plans in medicine. We must actively coordinate our activities with the administrative departments among public health and labor personnel as well as such groups as unions, women's associations and the youth corps. The projects or subjects chosen should be primarily focused on solving urgent problems with some long-term requirements. The investigation and exchange of basic theories must also be emphasized. The following are a few suggestions for future tasks.

1. Identify directions in order to executive party policies thoroughly:

The prevention and study of industrial hygiene and occupational diseases can be influenced not only by professionalism but also by policy. Therefore, we must thoroughly execute the various policies of the party, especially the policy of "prevention." We must always bear in mind that our work is to

protect the health of all workers in China and to create a good working environment for them so that they can smoothly contribute to socialist construction. We must further strengthen our ideology with respect to production and reality in order to serve the four modernizations. I sincerely hope that all delegates will lead the vast number of professionals to execute various party policies enthusiastically and voluntarily in order to reach the lowest levels and face production, to work hard in a realistic manner in order to solve all existing industrial hygiene problems for all the regions, plants and mines and to contribute to the protection of worker health. Our work involves both on-site inspection and laboratory research. Both areas are very important. However, the current trend seems to be to neglect on-site inspection. I hope that our comrades will pay more attention to overcoming this situation.

2. Strengthen academic exchange to improve continuously the quality of research and academic standards:

Academic exchange is an important task of society. It is also an effective measure to mobilize the enthusiasm of the workers and to improve the quality of scientific research and academic standards. I hope that each local chapter will seriously discuss the spirit and situation of this academic meeting. In particular, future academic activities should be strengthened and properly arranged. Before the Fourth National Academic Meeting is held, more academic activities at the single specialized field or regional level should be organized based on the need to promote the quality of scientific research. We must publish articles related to industrial hygiene and occupational diseases locally, and enthusiastically supply manuscripts to the CHINESE JOURNAL OF INDUSTRIAL HYGIENE AND OCCUPATIONAL DISEASES. These are important steps for the timely exchange and expansion of academic accomplishments. Members of the local committees are advised to contribute in this area.

3. Actively train technical professionals to accelerate the building up of teams:

As science and technology rapidly develop, new theories and technologies emerge continuously. There are more and more crossover areas between discipoines. New sciences are branching out every day. The content of industrial hygiene and occupational diseases is no exception. Toxicology was a new branch in the last meeting; however, we have already witnessed its growth in this meeting. Moreover, two new branches, i.e., occupational epidemiology and female industrial hygiene (or labor protection), have emerged. Obviously, they were created by interfacing industrial hygiene, occupational diseases, epidemiology and statistics or gynecology and obstetrics, pediatrics, embryology and biology. These were naturally and gradually created based on truly urgent needs. This type of growth (such as human efficiency and health management for various professions) will continue. This also fully reflects the upward mobility of this young science. The prospect is bright and unlimited.

Because development in industrial hygiene and occupational diseases is very fast, older professionals may deeply feel the problem of aging and lack of breadth of our knowledge. We are more eager to absorb new knowledge. We

need to use new theories, techniques and related sciences to arm ourselves. As the occupational disease control team expands, each unit will be filled with a large number of new people who did not have enough training in this special field. For these young people, the problem is to popularize special-field knowledge and to strengthen basic training. Therefore, it is also an important key point for creating new dimensions by providing training in industrial hygiene and prevention control and doing research on occupational diseases according to the "three stricts" system (strict requirement, serious attitude and solemn style) in order to improve the quality of this team. It is also an honorable duty of various societies and members to work hard to undertake this heavy burden so that we can learn from one another and collectively improve ourselves to accomplish this historic task. In our times, some professionals' ideology has not yet been solidified. We have to work harder to guide them positively in order to educate them. I believe that these incorrect ideologies will eventually be defeated.

The Ministry of Public Health has recently decided to appoint six old public health departments as training bases. In addition, there will be seven regional industrial hygiene and occupational disease control centers. They will be responsible for training above the resident doctor level. Public health departments or teaching and research offices in other medical schools and industrial hygiene and occupational disease control departments in various provinces, cities and autonomous regions are responsible for training the professional technical staff. This is a long-term project and an important investment in intelligence. I wish that everyone can contribute to the training of talented people who are highly specialized and politically motivated.

4. Improve efficiency and accelerate the drafting of health standards:

The current health standards for work palces and the diagnostic standards for occupational diseases cannot meet the actual demand regardless of quantity or quality. This not only brings a lot of difficulties to health supervision but also directly affects work on industrial hygiene and occupational disease control. China has 134 maximum allowable concentration limits for toxic species in work places and over a dozen diagnostic standards for occupational diseases, which are exceedingly inadequate in meeting the demand. The Ministry of Public Health planned to establish more than 400 health standards for work places by 1990. What should we do when facing such a difficult task? How can we accelerate to accomplish it?

In addition to participating in this work, we hope that everyone will pay attention to the following points: (1) We must address ourselves to the cause and effect relationship. It is the core to formulating maximum permissible concentration and also has significance in setting diagnostic standards for occupational diseases. (2) It is not necessary to start everything from scratch. We should avoid repeating work done abroad. The key is to grasp the available data and information and supplement it when necessary. Especially for some less toxic species which were thoroughly studied abroad and for which the permissible levels set by various countries are relatively close, we can recommend that the Ministry of Public Health adopt foreign standards to be implemented on a trial basis. (3) We must take full advantage of the enthusiasm of all areas and pay attention to the valuable data obtained on-site.

We must also include the work performed by comrades in special faraway areas (such as on a plateau). We must combine daily industrial hygiene monitoring, occupational disease control and the development of standards. (4) Standardization of the effort to develop standards and special-topic training must be strengthened to allow most people to grasp the technical knowledge regarding development of health standards.

5. Modify test methods, improve instrument quality and promote scientific research:

All the delegates in the meeting unanimously believe that in order to conduct good on-site surveys as the basis for formulating standards, we must first quickly improve all the techniques used in prevention control and research on industrial hygiene and occupational diseases. A number of light, durable, fast and accurate instruments are urgently needed for on-site monitoring. It is recommended that the Ministry of Public Health quickly contact the concerned departments to speed up the development of new instruments and devices. New instruments and devices already developed or copied should be rigorously evaluated. We should also assign plants to batch-produce these products and distribute them to various organizations according to a plan. This will provide a good material basis for the standardization of on-site monitoring methods.

This meeting was held under the guidance of the spirit of the 2d Session of the 12th Party Congress. The entire country is seriously executing the decision of the party and the spirit of the speeches given by Comrades Deng Xiaoping and Chen Yun at the Second Session. We must further study selected articles by Deng Xiaoping, important documents since the 3d Session of the 11th Party Congress and relevant publications by Mao Tsetung regarding the style and organization of the Communist Party. On our front we still must study hard to raise our awareness. We should rely on the leadership of the party to resist spiritual pollution. We should insist on the four basic principles to prevent erosion by capitalist ideology. In future work, we must focus on prevention and promote academic democracy. We must face production realistically. We must face the lower level of cadres and strengthen our collaboration in all areas of concern. We should learn from one another to improve ourselves and to create new dimensions in industrial hygiene and the control of occupational diseases in China in order to contribute more toward the early realization of the four modernizations.

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ELECTRONICS, COMPUTER SOCIETIES 1984 ACTIVITIES

Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese No 2, 1984 pp 64-65

[Table: "China Electronics Society and China Electronic Computer Society 1984 Activity Plan"]

[See table on following page]

[Text]

Name of Activity	Time & Place	Host Units	Cooperating Units	Scale	Notes
1. First International Conference on Computers and Their Applications	June 1984, Beijing				Jointly sponsored by China Electronics Society, China Electronic Computer Society and the U.S. Institute of Electrical and Electronics Engineers; Note: domestic preparatory meeting to be held in April, 1984 and to be attended by domestic authors and programmers
2. Exhibit of Achievements in Microcomputer Applications	1984, Xi'an	Microcomputer Branch and Shaanxi Science Committee	Shaanxi Microcomputer Branch		
3. Exhibit of New Microcomputer Products and Technology	1984, Guangzhou	Microcomputer Branch	Guangdong Science Committee and South China Normal University, Microcomputer Institute		

Name of Activity	Time & Place	Host Units	Cooperating Units	Scale	Notes
4. Microcomputer Applications and Development Training Class	1984	Computer Society and Wuhan Zhonghua Electronic Instrument Plant	Local Units concerned		
5. Third Exchange Meeting on Use and Maintenance Technoology of Peripheral Equipment	March 1984, Wuxi	Peripheral Equipment Study Group	Wuxi Electronic Computer Plant	150 persons	Jointly sponsored by China Electronics Society, China Electronic Computer Society and the U.S. Institute of Electrical and Electronics Engineers.
6. Second Computer Maintenance Technoology Conference	First Quarter 1984, Wuhan	Maintenance Study Group	Wuhan Institute 709	150 persons 6 days	Notice soliciting articles already issued
7. Second Microcomputer Program Design and Distributed Systems Conference	October 1984, Guilin	Microcomputer Program Design and Distributed Systems Study Group	Wang Shulin [3769 2885 2651] Chinese Academy of Sciences, Compucer Institute	150 persons 7 days	"
8. Conference on Design Automation of Digital Systems [CAD]	August 1984, Yantai	Specialization Group on Design Automation of Digital Systems	He Chengwu [0149 2052 2976] East China Computing Institute	100 persons 5 days	
9. Computer Education and Personnel Training Conference	September 1984, Hefei Industrial University	Education Specialization Group, Training Specialization Group	Research Institute of Hefei Industrial University, Beijing Univ. 2nd Branch School	200 persons	

Name of Activity	Time & Place	Host Units	Cooperating Units	Scale	Notes
10. Software Engineering Conference	Fourth Quarter, 1984	Software Branch	Zhu Sanyuan [2612 0005 0337] Shanghai Computing Institute	150 persons	Precise date will be set in mid-year when papers have been reviewed and preparations have been made.
11. Meeting of the Editorial Committee of Science Books Popularization	First Quarter 1984, Beijing	Popularization Committee		25 persons 3 days	
12. Second Exchange Meeting on Configuration Technology	October 1984, Changsha	Configuration Technology Specialization Group	National Defense University of S&T, Research Institute	100 persons 7 days	
13. Industrial Control-Computer Conference	Third Quarter 1984, Chongqing	Chongqing Institute of Automation		100 persons 5 days	Preparation group already set up
14. Computer Management System (Ministry and Commission 1 Level) Academic Exchange and Proposal Forum	1984, Beijing	Ministry of Electronics Industry, Bureau 6		70-80 persons	To accelerate bureau and ministry network applications work and to promote ministry, bureau and enterprise automated management.
15. Fourth Microcomputer Technology Conference	Second Quarter 1984, Wuhan	Microcomputer Branch	Wuhan Institute 709		On the basis of present situation in terms of articles, it has been proposed to delay the meeting; requests for articles have already been issued.
16. Second China Computer Diagnosis and Treatment Conference	March 1984, Wuhan	Shanghai Computer Institute and the Hubei Academy of Chinese Medicine	Central China Industrial College, Department of Computers	100 persons 6 days	105 articles have been received, and the review committee issued abstracts of the articles on 9 Dec 1983.

Name of Activity	Time & Place	Host Units	Cooperating Units	Scale	Notes
17. Conference on Data Base System Technology	July 1984, Tianjin	Sa Shixuan [5646 1597 3551] Software Branch			
18. Second Conference on Nonnumaric Applications	Third Quarter, 1984	Zhu Xuesong [2612 1331 1073] Chinese Academy of Sciences, Chengdu Inst. of Computers		100 persons 5 days	
19. Second Conference on Application of Microprocessors in Peripheral Systems	October 1984, Nanjing	Peripheral Equipment Group	Plant 734, Institute 52	100 persons 5 days	May be postponed until end of 1984 or early 1985, will deal with application of microprocessors in printers.
20. Conference on Triple and Multiple Value Logic	April 1984, Guangzhou		South China Industrial College	15 persons 5 days	
21. Exchange Conference on Artificial Intetelligence Technology	1984	Artificial Intelligence Study Group		100 persons 5 days	
22. Colloquium on Information Storage Technology	Late June 1984, Dalian	Information Storage Technology Study Group	Wei Baolin [7614 1405 2651] Shenyang Institute of Computers		To investigate the present state of information storage technology in China and abroad, discuss future directions
23. Colloquium on Local Networking of Microcomputers	August 1984, Chengde	Microcomputer Branch, System Structure Configuration Group	Shanghai Institute of Computers, Qinghua University	100 persons 5 days	
24. Colloquium on Computer Operations (Use) Management		Maintenance Specialization Study Group			Self-supporting

Name of Activity	Time & Place	Host Units	Cooperating Units	Scale	Notes
25. Conference on Disk Use and Maintenance Management Experience		Maintenance Specialization Study Group			Self-supporting
26. First National Conference on Computer Technical Training	April 1984, Suzhou	Technical Training Specialization Group	Suzhou Computer Plant	100 persons	
27. Colloquium on Computer System Performance Evaluation	Fourth Quarter, 1984	System Configuration Study Group	Su Dongzhuang [5685 2639 5445] Northwest Telecommunications Engineering College, Computer Dept.	40 persons 4 days	Place yet to be determined
28. Exhibit of Achievements in Microcomputer Applications	October 1984, Xi'an	Microcomputer Branch, Shaanxi Science Committee	Shaanxi Microcomputer Branch	300 persons 10-15 days	exhibits
29. Exhibit of New Microcomputer Products and Technology	Second Quarter 1984, Guangzhou	Microcomputer Branch	Guangdong Science Committee, South China Normal University, Microcomputer Institute	300 persons 10-15 days	Shanghai is also planning an exhibit, time to be determined
30. Network Technical Training Class	Second Quarter 1984, Taiyuan				
31. Training Group will hold several training classes in 1984					Plans to be announced

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TITLE: "Prompt Neutron Multiplicity at Various Fragment Mass Ratios and Kinetic Energies in Spontaneous Fission of ^{252}Cf"

SOURCE: Beijing YUANZIHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese Vol 6, No 1, Feb 84 pp 1-8

ABSTRACT: Although absolute measurements were made to obtain the average prompt neutron number ν_p and neutron distribution $p(\nu)$ in the spontaneous fission of ^{252}Cf by the authors in their earlier work, it would be more meaningful to know the average prompt neutron number $\bar{\nu}_p$ (M_H, E_K) and prompt neutron distribution $P_\nu(M_H, E_K)$ in studying the fission process. Prompt neutrons corresponding to the fragments from the spontaneous fission of ^{252}Cf were measured by a 60-cm diameter Gd-loaded liquid scintillating counter. The total kinetic energy of the fission fragments and the number of neutrons for each event were also recorded. The experimental data were obtained through a TRIDAC-C multi-channel analyzer system, processed on a NOVA-840 computer, and shown in terms of the average number of prompt neutron $\bar{\nu}_p(M_H, E_K)$ and the square of the width of prompt neutron distribution σ_ν^2 (M_H, E_K). Results were also compared to those obtained by others cited in references.

The manuscript was received on 21 March 1983.

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TITLE: "Measurement of $\bar{\nu}(Z)$ for Spontaneous Fission of ^{252}Cf"

SOURCE: Beijing YUANZIHI WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese Vol 6, No 1, Feb 84 pp 9-14

ABSTRACT: An experiment was carried out to determine $\bar{\nu}(Z)$ by measuring three correlating parameters: kinetic energy of a single fragment, average number of prompt neutron, and KX-rays, in the spontaneous fission of ^{252}Cf. The fission rate of the source was $1.9 \times 10^{4} min^{-1}$. A semiconductor detector, a Si (Li) X-ray detector, and a gadolinium-loaded liquid scintillating counter were used in the measurement. The signals were processed by a special electronic circuit and then transmitted to a multi-channel TRADAC-C computer. A total of 6.5×10^{5} effective events were recorded. The KX-ray spectrum measured from a spontaneous fission fragment of ^{252}Cf was in agreement with those obtained in earlier work. The average prompt neutron number of a single fragment was plotted against its charge number and no even-odd effect was observed. It was consistent with the result of an earlier work in which $\bar{\nu}(A)$ was measured.

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TITLE: "A High Intensity Monochromatic Gamma Source"

SOURCE: Beijing YUANZIHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese Vol 6, No 1, Feb 84 pp 15-22

ABSTRACT: A high-intensity, monochromatic gamma source was built at the swimming pool reactor in the Institute based on the principle of thermal neutron capturing. The reactor had a high neutron flux and the radiating body could be exchanged conveniently. Polyethylene and boron containing plastic materials were used to slow down and absorb neutrons to reduce the background level. The background of low energy gamma rays from the reactor was minimized by placing a bismuth block in front of the radiating body. The energy spectrum of the gamma source was measured by a Ge(Li) detector and the intensity was determined with a NaI(Tl) scintillating spectrometer. Results were obtained using iron, nickel, and beryllium as the radiating body. The energy of the gamma ray ranged from 4 MeV to 11 MeV and its intensity varied from $10^4 - 10^6$ /s·cm^2. The resonance excitation scattering spectra of Ge (γ, γ') and Pb (γ, γ') were studied with this gamma source. Results indicated that this monochromatic gamma source could be used in nuclear research and a series of other applications.

The authors wish to thank comrades DAI Chuanshan [2071 0278 1472] and HUANG Shengnian [7806 0524 1628] for their support and beneficial discussion, and ZHANG Guishan [1728 6311 1472] for calculating the efficiency of the scintillating detector. They also wished to thank the operators of the swimming pool reactor for the opportunity to use the reactor. The manuscript was received on 21 May 1983.

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